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Hygienic Assessment of Electromagnetic Pollution of the Production Environment by Collective Access Points of the Wi - Fi Standard

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Abstract The article presents the results of a hygienic assessment of the levels of electromagnetic radiation from routers and repeaters of wireless communication of the Wi - Fi standard. at workplaces in office premises of communication enterprises. The actual levels of electromagnetic radiation generated by wireless access routers of the Wi -Fi standard have been established. The studies have established that the levels of electromagnetic radiation from the equipment of the wireless Wi -Fi system at workplaces of the main and control groups of employees of communication enterprises of the city of Tashkent do not exceed the hygienic standards established for the premises of public buildings - 10 μW/cm2. The impact of electromagnetic radiation of Wi - FI equipment on the health of employees of communication institutions has been studied using a questionnaire survey based on subjective indicators.

Keywords Hygienic assessment, Wi -Fi equipment, Electromagnetic radiation, Workplaces, Questionnaire survey

1. Introduction

Wireless technologies have become an integral part of people's everyday life, have become familiar and ordinary. The current level of technology development allows using complex high-tech equipment without thinking about how it is designed and how it works. At the current stage of development of new technologies, sources of electromagnetic radiation (EMR) of low intensity (for example, Wi - Fi) are becoming increasingly important. equipment), the influence of which on the life processes of biological objects has not been sufficiently studied [1].

Wi -Fi - is a modern wireless technology for connecting computers to a local network and connecting them to the Internet. It is thanks to this technology that the Internet becomes mobile and gives the user freedom of movement not only within a room, but also around the world [2]. The presence of a large number of such sources is dictated by the development of modern technologies, the transmission of significant amounts of information via wireless communication.

Wi - Fi devices are usually placed in offices, public places, and they are also installed for home use, creating their own wireless networks. Research has established that electromagnetic radiation of the radio frequency range (EMR RF) is one of the serious factors of environmental pollution, causing the risk of adversely affecting the health of the population. Electromagnetic radiation of Wi - Fi devices can affect the biological systems of a warm-blooded organism through thermal or non-thermal effects [3].

When exposed to electromagnetic radiation Wi - Fi equipment in experimental animals, a reliable decrease in the indicators of horizontal and vertical motor activity is observed compared to the control group, which indicates the occurrence of stress in the animals; on the 25th day, a depressive state occurs and there is a slight slowdown in body weight gain [4].

The unique characteristics of wireless device systems include: low equipment cost, high reliability of network solutions, low requirements for the transmission medium, minimal installation and operating costs, ease of marketing, and the ability to use the existing infrastructure of the city telephone network [5,6,7].

Wi - Fi Equipment introduced at the household level or - used in places of mass presence of people, as a rule, is characterized by low intensity of EMI, but with its long-term operation, conditions of round-the-clock exposure can be created. The effects of exposure are not always acute, but there are prerequisites for their cumulation and, as a consequence, for the development of remote disorders leading to chronic disorders of a psychofunctional nature [8,10].

The results of studies assessing the effect of wireless - network modulation (2.45 GHz) indicate the induction of oxidative toxicity in the laryngeal-tracheal mucosa of rats. The effect of selenium and L -carnitine on the indices of EMI-induced oxidative stress in the blood of rats has been described [9,11].

Electromagnetic radiation with a frequency of 2.4 GHz from

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wireless networks and working phones affects the autonomic nervous system, causing changes in heart rhythm [12,13].

The influence of the electromagnetic field Wi - Fi has been studied equipment on changes in brain rhythms on EEG depending on gender. The study involved 50 women and 50 men who performed tests aimed at assessing short-term memory. All subjects were exposed to EMF at a frequency of 2.4 GHz. In this case, women, unlike men, showed a decrease in the strength of the alpha and beta rhythm. The differences between men and women were reliable [14].

Similar studies were conducted to assess the impact of Wi - Fi signals on concentration and working memory in a linguistic test in a group of 15 men and 15 women. It was found that the impact of EMF Wi - Fi can lead to changes in neural activity and depends on gender. This is associated with the amount of internal reserves for maintaining focused attention during a linguistic test [15].

2. Materials and Methods

Measurements actual levels of electromagnetic radiation (EMR) of the production environment were conducted in the office premises of communications enterprises in the city of Tashkent. The Wi - Fi standard equipment in the premises was represented by routers: wall-mounted «TP - Link Dego S4R», wall-mounted "TP-Link" with external radiating antennas, ceiling (suspended) mounted "Zyxel", "Huawei " and desktop mounted "AIR - AP 1131".

The studies were conducted at the workplaces of office workers of communications enterprises. To compare the EMI levels at the workplaces, the workers were divided into two groups: the first group (main), whose workplaces were located at a distance of up to 3 meters from Wi -Fi routers (29 workplaces) and the second group (control), employees whose workplaces were located at a distance of more than 3 meters from Wi -Fi equipment (29 workplaces).

The levels of electromagnetic radiation (EMR) at workplaces were measured using the PZ-42 EMR meter, serial number 034, manufactured by Electronpribor CJSC, Russia. The actual levels of electromagnetic radiation were determined at a height of 0.5, 1.0 and 1.2 meters in accordance with the requirements of GOST 12.1.006-84 "Occupational safety standards. Radio frequency electromagnetic fields. Permissible levels at workplaces and requirements for monitoring". To achieve this goal, 174 measurements of electromagnetic radiation at workplaces were performed.

3. Research Results and Their Discussion

In the process of measuring electromagnetic radiation at work places, conditions were created for maximum hardware power of the transmitter with active radiation of electromagnetic energy by the router into the surrounding space (when transmitting a large volume of information or high-quality video materials to at least 4 receiving terminals simultaneously).

The impact of electromagnetic radiation of Wi - Fi routers on the health of workers in the groups of workers studied was assessed by subjective indicators using a questionnaire based on a specially developed questionnaire. The respondents' answers to the questions posed made it possible to assess the possible adverse impact of electromagnetic radiation of the Wi - Fi standard on the health of workers.

The average age of workers in the main group is 35.3 ± 1.29 years, the average length of service is 12.16 years ± 1.65, in the control group the average age was within 41.17 years ± 1.71, the average length of service was 16.34 ± 2.0, respectively.

Wi -Fi wireless routers at workplaces in office premises of communications enterprises were established (Fig. 1). The average value of the generated parameters of the energy flux density of electromagnetic radiation of Wi -Fi standard equipment at a frequency of 2.4 GHz at workplaces of the first group is 0.77 ± 0.09 μW/cm^2. At workplaces of workers of the first group at a distance of up to 1 m from the router, the average value of electromagnetic radiation was determined at the level of 1.63 ± 0.04 μW/cm^2, from 1 to 2 m from the router - 1.11 ± 0.24 μW/cm^2 and at a distance of 2 to 3 m from the router the EMI levels were 0.51 ± 0.05 μW/cm^2, respectively.

The average value of the energy flux density levels of electromagnetic radiation at a frequency of 2.4 GHz at the workplaces of the second group of workers is 0.065 ± 0.013 μW/cm^2.

The surveys showed that 69% of the main group and 72.4% of the control group of respondents have been using Wi - Fi wireless transmission equipment for over 2 years in their work. The work schedule is 8 hours (93.1% and 96.6%, respectively), and the working week for the studied groups of workers is 5 days. 34.5% of the first group and 31% of the second group answered positively to the question about the possible adverse effects of electromagnetic radiation from Wi - Fi equipment on their health and the presence of a possible relationship between the location of wireless communication devices and the distance at which the device is installed.

The results of the questionnaire survey showed that 20.6% of the main and 6.9% of the control group of workers noted the presence of deviations in their health before connecting the equipment of wireless data transmission devices of the Wi - Fi standard, and after connecting, the number of subjective complaints about deterioration in health increased more than twofold and amounted to 48.3% in the main and 10.3% in the control groups of surveyed individuals. The survey of office workers made it possible to establish that 41.4% of the main and 10.3% of the control groups of surveyed individuals indicate an adverse effect of EMF of Wi - Fi equipment on their health, and 17.2 and 10.3% of respondents respectively believe that the reason for the deterioration of their health may be different. At the same time, 41.4% of the main group and 79.3% of the control group of subjects do not associate changes in their health with the impact of wireless data transmission equipment.

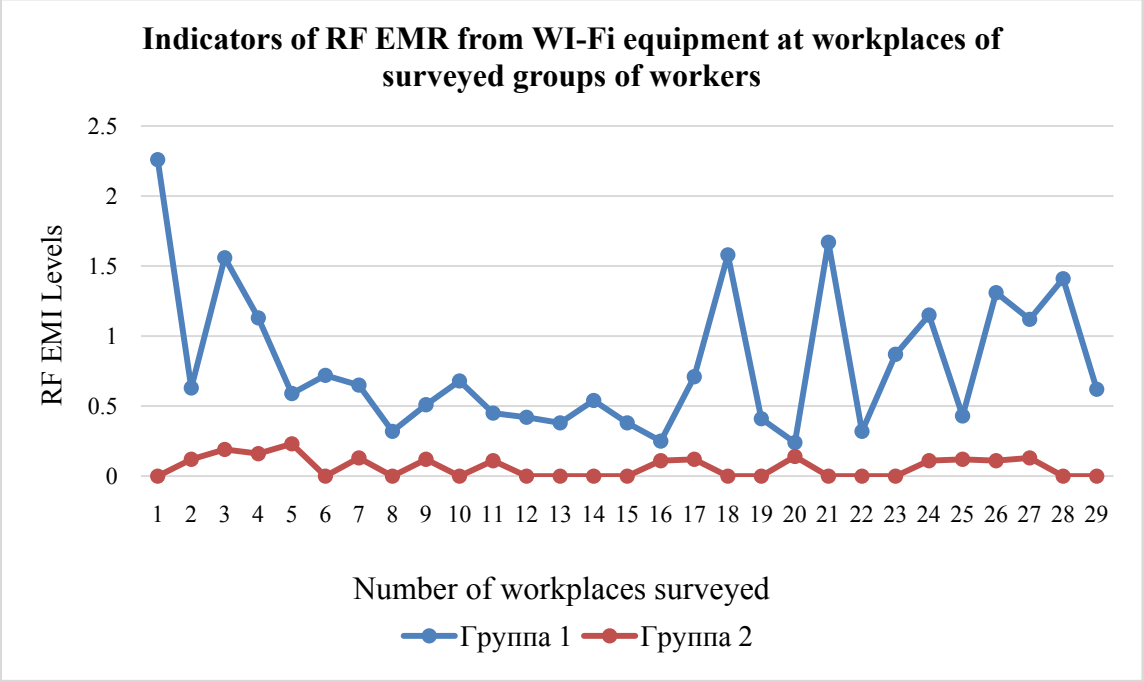

Figure 1. RF EMR values from Wi-Fi equipment at the workplaces

4. Conclusions

1. Research has established that the levels of EMR from Wi -Fi wireless system routers at the workplaces of office workers at communications enterprises do not exceed the maximum permissible levels (MPL) established for the premises of public buildings (10 μW/cm^2).
2. Wi -Fi standard EMF on the body's condition to be negative, while the number of subjective complaints about deterioration in health has more than doubled after connecting Wi-Fi standard wireless communication devices.
3. To determine the electromagnetic safety of routers of the standard Wi -Fi requires a chronic experiment to study hematological, biochemical, immunological and morphological parameters in experimental white rats under conditions of prolonged exposure to electromagnetic radiation in the radio frequency range.

REFERENCES

[1] Viktorov V.A., Meshalkin V.A., Saltykov V.M. Study of electromagnetic fields in the environment from the equipment of a computer complex from the standpoint of acceptable requirements for electromagnetic safety // Control, communication and security systems. - 2019. - No. 4. - P. 246-261.

[2] Grigoriev O.A., Rybalko S.Yu., Shibanov S.E., Yashchenko S.G. An integrated approach to the study of the influence of electromagnetic roles of modern communication devices on the human body // Hygiene and Sanitation. - 2018. - 97 (7) - P. 618 - 622.

[3] Dudarev A.A., Sorokin G.A. Actual problems of occupational hygiene and professional pathology of office workers // Occupational Medicine and Industrial Ecology. - 2019 - No. 4 - P. 1 - 8.

[4] Zibarov E.V., Afanasyev A.F. Research of the influence of Wi - Fi equipment on the organism of laboratory animals // Hygiene and Sanitation. - 2017. - No. 7. - P. - 661-664.

[5] Nikitina V.N., Lyashko G.G., Kalinina N.I. Analysis of the electromagnetic environment in modern office premises // Eurasian Union of Scientists (ESU). - 2014. - No. 6. - P. 45 - 47.

[6] Tashpulatova G.A., Krasavin A.N. Hygienic assessment of working conditions of system administrators and designers working with modern computer equipment // In the materials of the international scientific and practical conference "Nutrition and Health". Tashkent Medical Academy. - 2023.- P. 138 - 139.

[7] Tashpulatova G.A., Usmanov I.A., Krasavin A.N. Hygienic assessment of electromagnetic radiation from equipment of public access points located in residential buildings // In the Proceedings of the international conference "Innovative approaches to solving sanitary-hygienic and medical-biological problems of population health". Tashkent, - 2024. - P. 187-188.

[8] Titov E.V. Determination of the permissible time of stay in the zone of influence of electromagnetic radiation // Bulletin of the Altai State Agrarian University. 2014. - No. 3 (113). - WITH. 49 – 53.

[9] Aynali G., Naziroglu M., Qelik O., Dogan M., Yarikta § M., Yasan H. Modulation of wireless (2.45 GHz)-induced oxidative toxicity in laryngotracheal mucosa of rats by melatonin. Eur. Arch. Otorhinolaryngol. 2013; 270(5): 1695-700.

[10] Burlakova EB Features of the action of ultra-low doses of biologically active and physical factors. Rossiyskiy khimicheskiy zhurnal. 1999; 43(5): 3-11.

[11] Gumral N., Naziroglu M., Koyu A. et al. Effects of selenium

and L-carnitine on oxidative stress in blood of rats induced by 2.45-GHz radiation from wireless devices. Biol. Trace. Elem. Res. 2009; 132(1-3): 153-63.

[12] Havas M., Marrongelle J., Pollner B. et al. Provocation study using heart rate variability shows microwave radiation from 2.4GHz cordless phone affects autonomic nervous system. Eur. J. Oncol. Library. 2010; 5: 273-300.

[13] Havas M., Marrongelle J. Replication of heart rate variability provocation study with 2.45GHz cordless phone confirms original findings. Electromagn. Biol. Med. 2013; 32(2): 253-266.

[14] Maganioti AE, Papageorgiou CC, Hountala CD et al. Wi-Fi electromagnetic fields influence gender related alterations on EEG. In: 6th International Workshop on Biological Effects of Electromagnetic fields. Bodrum; 2010; 11(3): 189–212.

[15] Papageorgiou CC, Hountala CD, Maganioti AE et al. Effects of Wi-Fi signals on the p300 component of event-related potentials during an auditory hayling task. J. Integr. Neurosci. 2011; 10(2): 189–202.